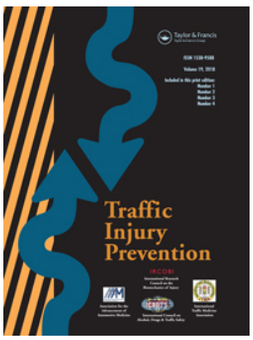

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Evaluation of Maryland's state police impaired driving reduction effort (SPIDRE)

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ABSTRACT

Objective: Alcohol-impaired driving is a significant factor in fatal and serious injury-producing crashes in the United States and many other countries. In 2013, the State of Maryland implemented an anti-driving under the influence (DUI) enforcement program, called the State Police Impaired Driving Reduction Effort (SPIDRE). This enforcement effort consisted of a select team of 7 police officers from the Maryland State Police who engaged in high-intensity driving under the influence (DUI) enforcement. The purpose of this evaluation was to determine the impact of the SPIDRE program on impaired-driving crashes, DUI arrests, DUI adjudicative outcomes, and public perceptions of DUI enforcement.

Methods: Data from alcohol-related crashes, arrests, and adjudicative outcomes of those arrests were used, along with data obtained from public opinion and bar patron surveys, to compare counties where the SPIDRE program operated and non-SPIDRE counties where it did not. The evaluation period extended from 2010 to 2016 in monthly intervals. Autoregressive integrated moving average (ARIMA) methods were used for the data analyses of crashes and arrests.

Results: There was no significant reduction in alcohol-related crashes as reported by the police associated with the SPIDRE program. However, there was a statistically significant decrease in the ratio of single-vehicle nighttime to multiple-vehicle daytime crashes in the SPIDRE counties but not in any other counties, suggesting a positive effect using this surrogate measure of impaired-driving crashes. The specific comparison counties as well as the other non-SPIDRE counties in Maryland experienced a statistically significant decrease in DUI arrests during the evaluation period, whereas the SPIDRE counties did not show such a decrease. Further, the arrests made by the SPIDRE team resulted in a significantly higher rate of positive adjudicative outcomes than arrests made by non-SPIDRE officers in those counties where the SPIDRE team operated. There was no evidence that the public was more aware of DUI enforcement efforts in the SPIDRE counties than in the non-SPIDRE counties.

Conclusions: The SPIDRE program appeared able to prevent a downward trend in DUI arrests, experienced by the rest of the state, and achieved higher quality arrests resulting in more positive adjudicative outcomes. The way in which the SPIDRE team was deployed may have lacked sufficient duration and intensity (e.g., only 2–3 months of activity in any given county) to achieve a reduction in alcohol-impaired-driving crashes as reported by the police. It is recommended that the SPIDRE team increase its enforcement activities for at least 9–12 consecutive months in the county where they are employed.

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Introduction and background

According to the NHTSA, more than 10,000 people died in alcohol-impaired-driving crashes in the United States in 2015. This represents one fatality every 51 min (National Center for Statistics and Analysis 2016). Substantial progress has been made in reducing impaired driving in the United States since the early 1980s. According to NHTSA's Fatality Analysis Reporting System, the proportion of all drivers in fatal crashes estimated to have been legally intoxicated (blood alcohol concentration [BAC] $\geq$ 0.08 d/gL) has decreased from 35% in 1982 to 20% in 1997, a 43% decrease in that proportion. However, since 1997, that proportion has varied only slightly up to the current time. Further, there appears to be wide variability in each state, in that the percentages range from a low of 12% in Utah to a high of 31% in Montana (NHTSA 2016).

Among the many reasons for this wide variability in the states are the strategies used for impaired-driving enforcement. Most states currently have a good infrastructure of impaired-driving laws, so all other factors being equal, states with highly visible, highly publicized impaired-driving enforcement programs tend to have lower impaired-driving crash rates (Goodwin et al. 2015). Georgia is a good example. It has had highly visible, frequent, publicized driving under the influence (DUI) enforcement activities that included sobriety checkpoints and saturation patrols, which were conducted throughout the state for the past several years (Fell et al. 2008). It now has one of the lowest

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impaired-driving rates in fatal crashes in the nation, going from 34% in 1982 to 15% in 2011, a 56% reduction in that proportion.

In contrast, Maryland has gone from 32% in 1982 to 22% in 2011, a 31% decrease in the proportion of drivers in fatal crashes with BACs ≥ 0.08 g/dL. Almost a third (32%) of Maryland drivers involved in fatal crashes were intoxicated (BAC ≥ 0.08 g/dL—the nation was at 35%) in 1982. By the year 2000, Maryland had adopted most of the key DUI laws (Fell and Lacey 2011) and improved its DUI enforcement. In that year, the proportion of drivers involved in fatal crashes who were intoxicated declined to 17% (the nation was at 21%).

Research has shown that the most effective approach to the problem with the most immediate effect on impaired driving occurs at the local level, where laws are most likely to be applied and enforced. These include such things as publicized sobriety checkpoints and high-visibility saturation patrols (Goodwin et al. 2015). Ferris et al. (2013) showed that increases in random breath testing (which is legal in Australia but not in the United States) were associated with a significant reduction in alcohol-related traffic crashes. Fell et al. (2014) found that communities that had a higher number of DUI arrests per capita had a significantly lower ratio of drinking-driver crashes to non-drinking-driver crashes. Specifically, a 10% increase in the DUI arrest rate was associated with a 1% reduction in the drinking driver crash rate. In 2010, the state of Washington implemented a high-intensity enforcement campaign entitled Target Zero Teams Project (TZTP). This campaign involved specially trained members of the Washington State Police, who focused their enforcement efforts on specific impaired-driving "hot spots" in certain counties in the state. There were notable countywide net increases in DUI arrests by TZTP troopers in the TZTP counties compared to non-TZTP counties. In addition, the TZTP counties had a relative reduction of 24.8% in driver alcohol involvement (BAC > 0.01) in fatal crashes compared to the non-TZTP counties (Thomas et al. 2015). It was estimated that the TZTP program saved 11 lives in Washington, making it highly cost effective.

Between 2000 and 2003, NHTSA funded demonstration projects designed to reduce impaired driving through well-publicized and frequent enforcement in 7 states: Georgia, Indiana, Louisiana, Michigan, Pennsylvania, Tennessee, and Texas. Significant reductions in fatal crashes in the intervention states relative to surrounding states were obtained in Georgia, Indiana, Michigan, and Tennessee when an interrupted time-series analysis of Fatality Analysis Reporting System data was used comparing the ratio of drinking to nondrinking drivers in fatal crashes (Fell et al. 2008). Significant reductions in a second measure, alcohol-related fatalities per 100 million vehicle miles traveled, were also obtained in Indiana and Michigan. The other 3 states showed only marginal, nonsignificant changes relative to their comparison jurisdictions or states. Compared to surrounding states, fatal crash reductions in Georgia, Indiana, Michigan, and Tennessee ranged from 11 to 20%. In these 4 states, the programs were estimated to have saved lives ranging from 25 in Indiana to 43 in Tennessee to 57 in Michigan to 60 in Georgia. Some common features of the programs that experienced significant reductions included the use of paid media to publicize the enforcement (in 3 states), using a statewide model rather than selected portions of the state (all 4 states), and the use of highly visible and frequent sobriety checkpoints (in 3 states). In summary, it appears that a variety of media and enforcement procedures that supplement ongoing statewide efforts can yield meaningful crash reduction effects among alcohol-impaired drivers (Davey and Freeman 2011; Elder et al. 2004; Homel 1990).

In 2013, Maryland undertook a similar program, entitled State Police Impaired Driving Reduction Effort (SPIDRE). Initially, a team of 7 Maryland State Police officers were selected and dedicated to this campaign. Their purpose was to conduct high-intensity DUI enforcement in data-driven locations (hot spots) where DUI crashes had been more likely to occur. Their enforcement efforts were accompanied by paid and earned media that promoted this enforcement effort. Initially, this effort occurred in Baltimore County in May 2013 and then in September and October 2013. After those 3 months, this team was relocated to other counties for various periods of time ranging from 2 to 3 months.

The purpose of this evaluation was to assess the effectiveness of the SPIDRE program. Specifically, we compared the SPIDRE team's impact in a county where a clear start date could be established (Montgomery County) to counties (Cecil and Harford) where it was clear that SPIDRE team efforts had not occurred nor would occur. We used the 5-year period before and one year period after in a pre-/posttreatment/comparison evaluation design. During the course of this evaluation, the SPIDRE team operated in other counties (Anne Arundel, Baltimore, and Prince Georges). Therefore, for certain analyses we were able to compare their DUI arrest and crash rates to the rest of the state where the SPIDRE program had not operated.

Methods

DUI crash data

DUI crash data were provided by the National Study Center for Trauma and Emergency Medical Systems at the University of Maryland–Baltimore as a part of their Crash Outcome Data Evaluation System program. A DUI crash was defined as one where the investigating officer indicated on the police report that one or more of the drivers in the crash was alcohol-impaired. Another measure of impaired-driving crashes was used in the analyses: The ratio of single-vehicle nighttime (SVN; 6 p.m.–6 a.m.) crashes to multiple-vehicle daytime (MVD; 6 a.m.–6 p.m.) crashes. Because police do not test every driver involved in a crash for alcohol, the above measure has been used in past research serving as a surrogate measure of impaired-driving crashes to account for underreporting of impaired drivers by police. Voas et al. (2009) updated a study by Heeren et al. (1985) confirming the validity of the SVN surrogate for alcohol-related crashes. SVN crashes have a high probability of alcohol involvement, whereas MVD crashes have a low probability of alcohol involvement. The ratio of SVN crashes from 6 p.m. to 6 a.m. to MVD crashes from 6 a.m. to 6 p.m. was used as the surrogate measure to help control for other factors in the county. Crash data were examined over a period from 2010 to 2016. This spanned the period well before and after the SPIDRE program was in operation. Autoregressive integrated moving average (ARIMA) methods were used in the analyses.

DUI arrests

DUI arrest data were also examined and compared over a similar time period. A variety of methods and comparisons were used. These are explained in the results section. ARIMA methods were used in these analyses also.

Adjudicative outcomes of DUI arrests

Finally, the dispositions of the DUI arrests were determined and compared in those counties (Anne Arundel, Baltimore, Montgomery, and Prince George's) where the SPIDRE program has operated. Comparisons were made of the arrests made by SPIDRE team members versus non-SPIDRE team members in each of these counties, using the chi-square test. The dispositions were grouped into 2 categories of outcomes: favorable, defined as a guilty or PBJ (probation before judgement) disposition, and unfavorable, defined as a not guilty, STET (inactive case but may be prosecuted later if additional information is obtained or if a subsequent arrest is made) or an NP disposition (where the courts decline to prosecute the case due to concerns about the facts/evidence in the case). According to a member of the Maryland State's Attorneys' Association, first-time DUI offenders with a low BAC at the time of arrest (BAC < 0.15) where no evidence of personal or property damage has occurred are usually given a PBJ as their disposition. Multiple offenders or first-time offenders with a high BAC (>0.15) or where an injury or property damage had occurred are usually given a guilty conviction as their disposition. Thus, grouping these 2 dispositions together provides a way of examining a positive adjudicative outcome and was used as a measure of a higher quality arrest (i.e., one leading to a positive outcome).

Public opinion surveys

A variety of measures were used to evaluate the impact of this program. The first was a series of surveys, to gauge public awareness and response to the SPIDRE efforts. Two approaches were used: Public opinion surveys and bar patron surveys. A telephone survey questionnaire was developed and administered to a random sample of 400 residents in Montgomery County (SPIDRE) and Cecil/Harford (non-SPIDRE) counties, before the SPIDRE program began. This enabled us to collect baseline data. A comparable sample of 400 residents in each jurisdiction (SPIDRE and non-SPIDRE) was surveyed 6 months later after the program had been operating in the SPIDRE county (Montgomery). A professional marketing firm was used to collect these data, using random-digit-dialing methods.

Bar patron surveys

People who were exiting various bars in Montgomery and Cecil/Harford counties have been shown to be more likely to be drinking and driving than the general public. Several studies have revealed that about half of intoxicated drivers had their last drink at a bar or restaurant (Anglin et al. 1997; Damkot 1979; Eby 1995; Foss et al. 1990; O'Donnell 1985; Ontario Ministry of Transport and Communications 1980; Palmer 1986; Stockwell et al. 1993). Fell et al. (2010) found that over 60% of offenders arrested for alcohol-impaired driving in Maryland had their last drink at a bar or restaurant. Thus, people exiting bars were viewed as more likely to be influenced by the SPIDRE enforcement. Pre- and posttest bar/patron surveys were conducted and used to collect data in order to gauge whether these bar patrons were aware of anti-drunk driving enforcement efforts in their county. They also were asked to provide an anonymous measure of their BAC using a portable breath testing unit. These people were identified as most likely to be drinking and driving and therefore potentially influenced by the SPIDRE enforcement efforts. Approximately 100 patrons were surveyed outside of selected bars in each jurisdiction before the SPIDRE program began and 100 patrons were surveyed 6 months later after the program had been operating in the SPIDRE county.

Institutional Review Board approval was obtained from all institutions involved in this evaluation.

Results

Crash analyses

Impaired-driving crashes as well as DUI arrests, as reported by the police, were examined for each county in Maryland for the period of 2010 to 2016. This included the period before and after the SPIDRE team was implemented. Various analyses and comparisons were performed for each of the 4 counties where the SPIDRE team operated (Anne Arundel, Baltimore, Montgomery, and Prince Georges) and to the comparison counties (Cecil and Harford) as well as all other non-SPIDRE counties throughout Maryland.

Using ARIMA analyses to detect whether there was a significant change in trend over time, the results showed that SPIDRE counties (Anne Arundel, Baltimore, Montgomery, and Prince Georges, combined) did see a decrease in impaired-driving crashes, using a median start date for the SPIDRE program. On average, crashes decreased by about 29.9 impaired-driving crashes per month. This is approximately a 9.1% decrease. However, impaired-driving crashes also decreased in the comparison counties (Cecil and Harford, combined) during this same time period by 4.1 impaired-driving crashes per month or about a 10.4% decrease, because they are smaller counties. The impaired-driving crashes also decreased in the "other" counties (all other non-SPIDRE counties, combined) during this same time period by 56.1 impaired-driving crashes per month or about an 18.2% decrease. All 3 decreases were statistically significant (see Figure 1); however, the decrease in the crashes in the SPIDRE counties was significantly less than the decrease in impaired crashes in the comparison and non-SPIDRE counties.

Impaired-driving crashes were also examined in each of the SPIDRE counties using the actual SPIDRE start date in that county. The results of any changes were not statistically significant. There were small reductions in Baltimore and Prince Georges counties, but the results were not statistically significant.

Next, a ratio of SVN crashes to MVD crashes was used as a different perspective on measuring impaired-driving crashes (serving as a surrogate measure of impaired-driving crashes to

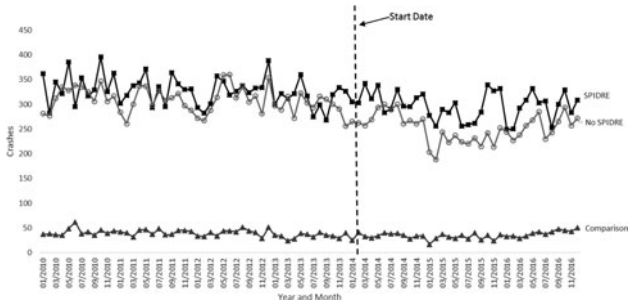

Figure 1. Trends in alcohol-related crashes in Maryland counties: SPIDRE counties vs. non-SPIDRE counties, monthly: 2010–2016.

account for underreporting of impaired drivers by police). There was a statistically significant decrease of 0.009 in the ratio of SVN to MVD crashes in the SPIDRE counties but not in any other counties (see Figure 2).

DUI arrests

SPIDRE counties did not experience any measurable change in DUI arrests. However, DUI arrests decreased in comparison counties (Cecil and Harford) during this same time period by 27.5 DUI arrests per month or about an 18.7% decrease. DUI arrests also decreased in the other non-SPIDRE counties during this same time period by 133 per month or a 12.8% decrease. Both decreases were statistically significant. Further, when each of the SPIDRE counties were examined by their actual start date in that county, Baltimore County experienced an increase in DUI arrests by approximately 14.2% and Prince Georges County experienced an increase by approximately 43.1%. Both increases were statistically significant. Montgomery County and Anne Arundel County changes in DUI arrests were not statistically significant (see Figure 3).

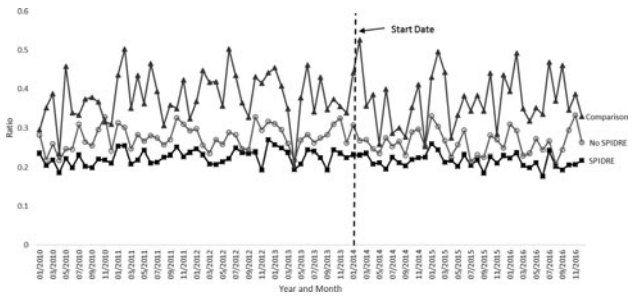

Figure 2. Ratio of single vehicle nighttime crashes to multiple vehicle daytime crashes in Maryland: SPIDRE counties vs. non-SPIDRE counties.

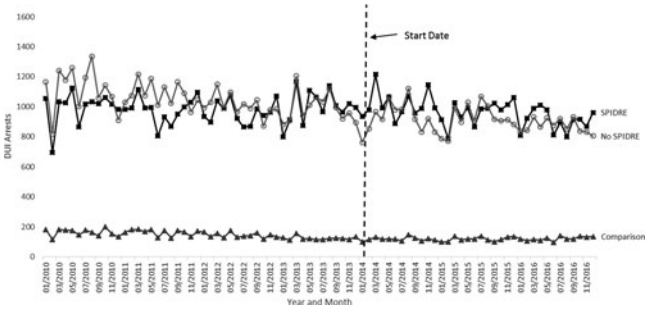

Figure 3. Trends in of DUI arrests in Maryland counties: SPIDRE counties vs. non-SPIDRE counties, monthly: 2010–2016.

Adjudicative outcomes

A comparison was made of the dispositions of DUI arrests that were made by the SPIDRE team and non-SPIDRE officers in the 4 counties (Anne Arundel, Baltimore, Montgomery, and Prince Georges) for the specific months that the SPIDRE program operated. Across all 4 counties, positive adjudicative outcomes (defined as a guilty verdict or PBJ were significantly greater in arrests made by the SPIDRE team (82.78%) than made by the non-SPIDRE officers (69.24%, $\chi^2 = 86.22$, $P < .001$).

This analysis was repeated for each of the SPIDRE counties. There were a higher proportion of positive adjudicative outcomes for the SPIDRE team arrests in Anne Arundel County (87.27 vs. 82.57%); however, this was not statistically significant. There was a higher proportion of positive adjudicative outcomes in Baltimore County (92.17 vs. 88.44%), Montgomery County (87.22 vs. 80.45%), and Prince Georges County (64.91 vs. 39.82%). The differences in Baltimore and Prince Georges counties were statistically significant ($P < .0001$), whereas the difference observed in Montgomery County was marginal and approached but fell just short of conventional standards of statistical significance ($P < .05$).

Public survey analyses

The results of the pre–post comparative analyses of the phone survey data (Table A1, see online supplement) revealed that there was no evidence of an increase in perceptions of police presence in any of the jurisdictions (Montgomery vs. Cecil and Harford). There was no evidence of an increase in awareness of police efforts to reduce driving under the influence of alcohol in any of the jurisdictions. There was evidence of an increase in the perceptions that it would be very likely to be stopped by the police for drunk driving in Montgomery County (20.0 vs. 27.3%, $P < .01$) but not in Cecil/Harford counties (32.8 vs. 37.2%). However, there was a decrease in the perceived likelihood of being convicted of DUI in both jurisdictions. There was a significant decrease in perceptions of how likely it is that a drinking driver would be stopped by the police in the last 6 months in Cecil/Harford counties and a nonsignificant decrease in Montgomery County. Finally, there was evidence that residents of Montgomery County (16.3%) were more aware of the SPIDRE program than residents of Cecil/Harford counties (12.8%), but these differences were not statistically significant.

Bar patron surveys

The results of the analyses of the bar patron survey data (Table A2, see online supplement) revealed that there was evidence of a nonsignificant increase in message awareness of drunk driving enforcement in Cecil/Harford counties, whereas there was a nonsignificant decrease in Montgomery County. There was no evidence of any significant change in perceptions of enforcement efforts by police to reduce driving under the influence in either county/jurisdiction; however, there was a marginal difference suggesting a slight increase in awareness in Montgomery County (63.9 vs. 68.7%).

There was evidence of an increase in perceptions that police are enforcing efforts to reduce drunk driving more regularly in Cecil/Harford counties (32.4 vs. 47.4%, $P < .05$) but not in Montgomery County. There was evidence of an increase in the perception that one would be very likely to be stopped for drunk driving in Cecil/Harford counties (23.4 vs. 37.4%, $P < .05$) but no evidence of a change in Montgomery County; however, there was a marginal difference in Montgomery County suggesting a slight increase in the perception (56.5 to 59.6%) that it was very or somewhat likely (combined) in Montgomery County than in Cecil/Harford counties. There was no evidence of change in the perceived likelihood that one would be convicted if one were stopped for driving after drinking alcohol in excess. There was no evidence that the bar patrons of Montgomery County (21.0%) were more aware of the SPIDRE program than the bar patrons of Cecil/Harford counties (19.6%). The results of portable breath testing readings showed that the bar patrons of Cecil/Harford counties were significantly more likely to have positive BAC readings (BAC $\geq$ 0.01) during the posttest (83%) compared to the pretest (75%), whereas there was no significant difference in posttest (64%) to pretest (75%) comparisons for Montgomery county even though the percentage went down. In both counties, there was no difference in the percentage of intoxicated (BAC $\geq$ 0.08) patrons from pretest to posttest.

Discussion

The results of this evaluation did not show any direct evidence of a DUI crash reduction effect of the SPIDRE team using police-reported alcohol involvement in the crash reports. However, there was a significant decrease in the ratio of SVN crashes to MVD crashes, suggesting indirect evidence for a crash effect using this surrogate measure of impaired-driving crashes. Further, there was evidence that the SPIDRE team was able to prevent a downward trend in DUI arrests, as much as 6% in some counties, and was associated with an increase of 14–43% in some SPIDRE counties. Most important, the SPIDRE program was associated with a 12% increase in the rate of positive adjudicative outcomes from DUI arrests. Unfortunately, there was no evidence to indicate that these benefits extended to non-SPIDRE officers in the same county where this program operated.

The way in which the SPIDRE team was deployed may have lacked sufficient duration and intensity (e.g., only 2–3 months of activity in any given county) to achieve a reduction in alcohol-impaired-driving crashes as reported by the police. Therefore, several recommendations can be made to address this issue. First, the SPIDRE team should consider increasing enforcement activities for at least 9–12 consecutive months in the county where it is deployed. It appears that the transient nature of how the SPIDRE team was deployed was insufficient to achieve an increase in public awareness or a detectable reduction in crashes (see Fell et al. 2008). It is recommended that Maryland adopt an implementation program similar to the one used in the state of Washington's Target Zero Teams Project (Thomas et al. 2015).

Second, we recommend that the SPIDRE teams be expanded so that each county (or at least the largest counties) will have its own team of various sizes. This would provide greater continuity and reduce travel time for court case hearings that occur out of county from where the SPIDRE team member operates. Further, it would help to diffuse the SPIDRE team spirit and tactics to other local police force members in that county. No evidence was found that the positive effect on adjudicative outcomes observed by the SPIDRE team extended to the non-SPIDRE officers, in those counties where the program operated. Finally, employing county-specific SPIDRE teams would allow greater familiarity with judges and district attorneys and may help with the successful prosecution of DUI cases.

Third, publicity and media coverage (including social media) of the SPIDRE teams could use more innovative methods. There was very low awareness of the SPIDRE teams in the telephone and bar patron surveys. This is important if a general deterrent effect is to be experienced. Perhaps the clearest demonstration of the role of media in influencing DUI enforcement is provided by the results of the "Community Trials" program (Holder et al. 2000), which documented a major effort to use media advocacy to publicize driving while under the influence enforcement programs in 3 communities. In a study (Voas et al. 1997) of this program, the immediate outputs of the media and enforcement efforts were measured, such as the number of mentions of the enforcement program on the local nightly news and the number of checkpoints conducted. Telephone surveys were used to assess the combined influence of the 2 factors on the public's perception of risk. In addition, the number of drivers with a high BAC on the road was measured through roadside surveys and, finally, crash data were used to determine the extent of reductions, if any, in alcohol-related crashes. The positive results from the Voas et al. (1997) study indicated the combined effects of enforcement and publicity rather than the publicity alone.

Finally, due mainly to the success of the Washington State TZT program model of a team of state police officers focusing their enforcement solely on DUI (Thomas et al. 2015), some states in the United States are starting to initiate similar programs (e.g., Virginia). In Maryland, there has been moderate success with the SPIDRE program, especially concerning DUI arrest rates, which have been associated with reductions in drinking and driving (Fell et al. 2014). Other states (and countries) might want to consider creating similar special DUI enforcement teams in their efforts to reduce impaired driving.

In summary, the SPIDRE program had a modest impact on DUI in Maryland and with modifications could have an even greater effect. The increase in DUI arrests and the decrease in SVN crashes indicate a positive benefit/cost. However, better publicity, increased visibility, and a longer duration of DUI enforcement in any given county would most likely increase the program impact.

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